To :

Specification of TFT-LCD module

NA19020-C961

Approval
Date :
By :

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Specification No. : Tech Bes LCD-00199

Issue Date : Oct. 17, 2003

Issued by : F. Yamada

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FUJITSU DISPLAY TECHNOLOGIES CORPORATION

Specification of TFT-LCD module

Model No. : NA19020-C961

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1. APPLICATION

This specification is applied to the 19-inch SXGA supported TFT-LCD module.

2. PRODUCT NAME AND MODEL NUMBER

2–1 Product Name : **LCD Module**

2-2 Model Number : NA19020-C961

3. OVERVIEW

This LCD module has a TFT active matrix type liquid crystal panel 1280x1024 pixels, and diagonal size of 48cm(19-inch). This LCD has a LVDS dual interface and can display 16,777,216 colors.

The power supply of this LCD module is +5V DC voltage.

This module has the characteristics for applying TCO'99.

4. CONFIGURATION

This LCD module consists of a color TFT-LCD panel that is mounted with TFT driver ICs and a cold-cathode fluorescent tube back-light.
The inverter for the back-light is not included.
Figure 4-1 shows a block diagram of this LCD module.

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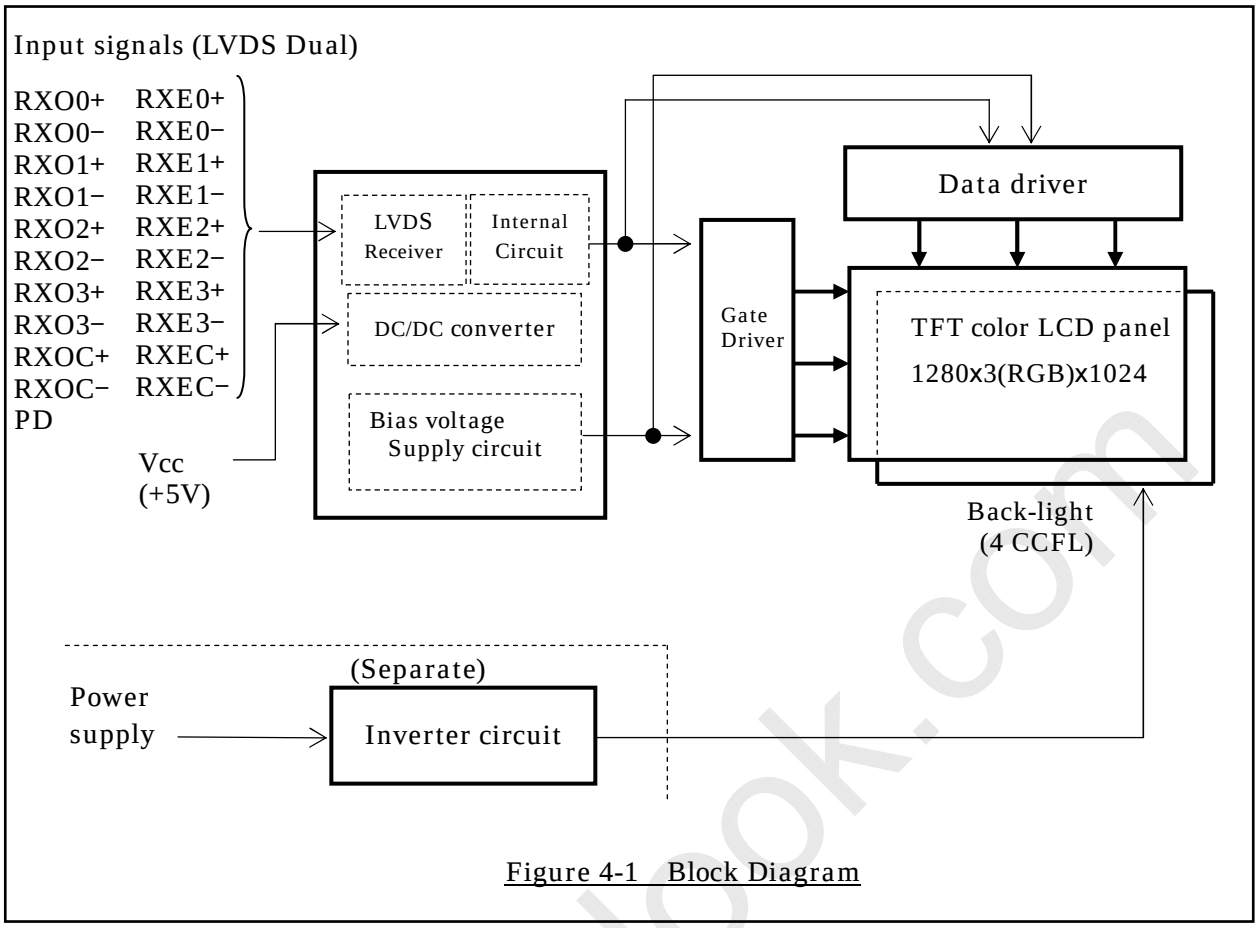

Figure 4-1 Block Diagram

5. MECHANICAL SPECIFICATIONS

Table 5-1 shows the mechanical specifications of this LCD module.

Table 5-1 Mechanical Specifications

Item	Specifications	Unit	Remark
Dimensions	414x335x23(TYP.)	mm	Edge type back-light is used. (φ2.6 CCFLx4)
Display Resolution	(1280x3)x1024	—	Without inverter.
Display Dot Area	376.32x301.056	mm	For details on dimensions, see dimensional outline drawing. (Figure 19-1,2,3)
Dot Pitch	(0.098x3)x0.294	mm	
Pixel Aspect Ratio	1:1	—	
Weight	3,000 MAX	g	Excluding inverter.
FG-SG	Short circuit	—	

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6. ABSOLUTE MAXIMUM RATING

Table 6-1 shows the absolute maximum rating of this LCD module.

Table 6-1 Absolute Maximum Rating

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}	Ta=25ºC	–0.3	—	6.0	V
Input Signal Voltage (LVDS signal, PD)	V_{IN}	Ta=25ºC	–0.3	—	3.6	V

7. RECOMMENDED OPERATING CONDITIONS

Table 7-1 shows the recommended operating conditions of this LCD module.

Table 7-1 Recommended Operating Conditions

Item		Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage(Logic)		V_{CC}	4.75	—	5.25	V
Ripple Voltage	V_{CC}	V_{RP}	—	—	0.1	V

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8. ELECTRICAL SPECIFICATIONS

Table 8-1 shows the electrical specifications of this LCD module. Figure 8-1 shows the measurement circuit. Figure 8-2(A) shows the equivalent circuit of the logic signal input area. Figure 8-2(B) shows the equivalent circuit of the supply voltage Input area.

Table 8-1 Electrical Specifications

Item		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remark
Differential-input Voltage (Hign)		V_{IH}	V_{CM}=+1.2V	—	—	100	mV	
Differential-input Voltage (Low)		V_{IL}	V_{CM}=+1.2V	–100	—	—	mV	
Input PD Voltage (High)		V_{IHPD}	V_{CC}=+5.0±0.25V V_{SS}=0V DCLK=54MHz Ta=25° C	2.0	—	3.3	V	
Input PD Voltage (Low)		V_{ILPD}		0	—	0.8	V	
Supply Current		I_{CC}		—	800	1,500	mA	*1
Supply Rush Current		I_{SCC}		—	—	3.5	A	*2
Supply Rush Current Duration(1.5A excess)		T_{SCC}		—	—	1	ms	
BACK LIGHT (*3)	CCFL Turn on Voltage	V_S	f_L=50kHz,Ta=25°C	—	1,400	1,600	Vrms	
			f_L=50kHz,Ta=0°C	—	—	1,600		
	Lighting Voltage	V_L	f_L=50kHz I_L=7mA	—	750	—	Vrms	
	Lighting Frequency	f_L	V_L=750Vrms	40	50	60	kHz	
	Tube Current	I_L	f_L=50kHz V_L=750Vrms	4	7	8	mArms	*4

(*1) Typical current situation : Color bar pattern. Vcc=5.0V
Maximum current situation : White pattern. Vcc=4.75V
Without rush current.

(*2) These items prescribe the rush current for starting internal DC/DC.
Charging current to capacitors of Vcc is not prescribed.

(*3) Back-light specifications are valid when using a suitable inverter such as the FLCV-13

(*4) Tube current (I_L) shows the value of the current that is consumed at one lamp.
This LCD module has 4 lamps. Each 2 lamps are placed at upper side and lower side of the display.
2 lamps is connected in parallel. Each low voltage terminals are connected with separate cable to Back-light connecter.

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Measurement circuit is based on Figure 8-1.

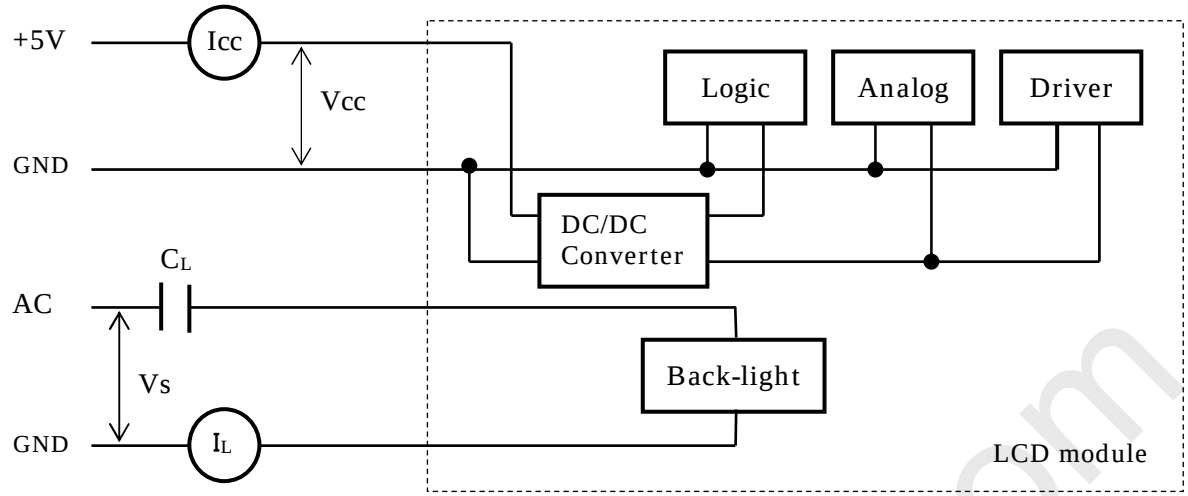
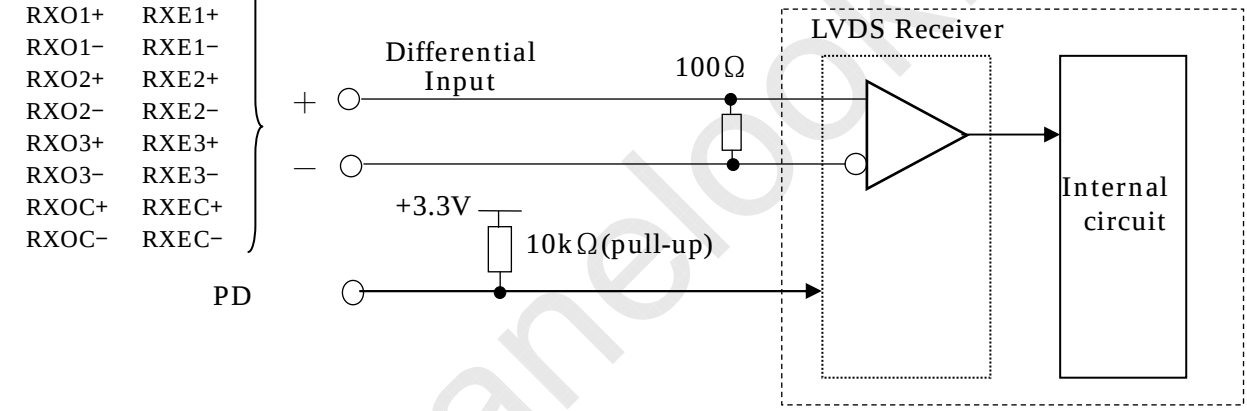


Figure 8-1 Measurement circuit

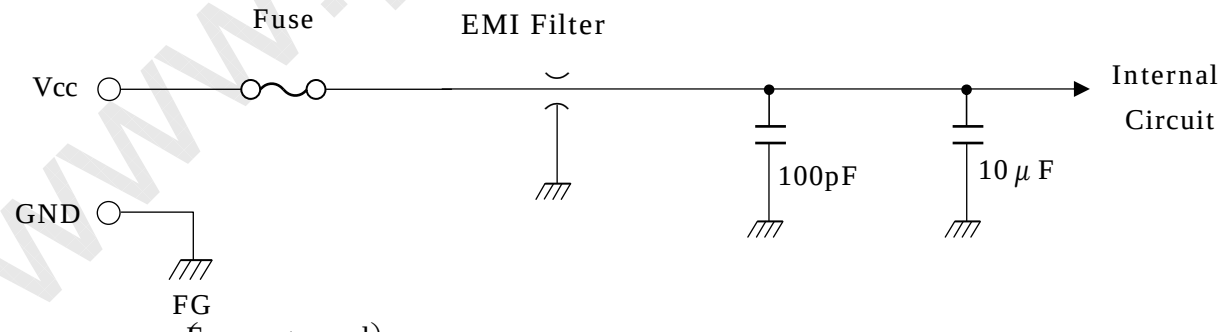
Input signals (LVDS Dual)

RXO0+	RXE0+
RXO0−	RXE0−
RXO1+	RXE1+
RXO1−	RXE1−
RXO2+	RXE2+
RXO2−	RXE2−
RXO3+	RXE3+
RXO3−	RXE3−
RXOC+	RXEC+
RXOC−	RXEC−



LVDS Receiver : DS90CF386 (National Semiconductor Corp. or equivalent)

Figure 8-2(A) Equivalent circuit of logic signal Input



Fuse : F0603C3R00FWTRM 3.0A (Kyocera Corp. or equivalent)

EMI Filter : SGM20C1E332 (Sumitomo Metal Inc. or equivalent)

Figure 8-2(B) Equivalent circuit of power supply

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9. OPTICAL SPECIFICATIONS

Table 9-1 shows the optical specifications of this LCD module.

Table 9-1 Optical Specifications — Ta=25˚C, Signal timing=Typ.

Item		Symbol	Condition		Specifications MIN.	TYP.	MAX.	Unit	Remark	Note
Visual Angle	Horizontal	$\theta_{L,R}$	CR≧10	$\theta_{U,D}$=0°	85	—	—	deg		(1)(2)(3)(5)(6)
	Vertical	$\theta_{U,D}$		$\theta_{L,R}$=0°	85	—	—	deg		
	All Direction	θ			—	80	—	deg		
Contrast Ratio		CR	$\theta_{L,R,U,D}$=0°		400	600	—	—	White/ Black	(1)(2)(3)(5)
Response Time(ON) (B→W)		t_{on}	$\theta_{L,R,U,D}$=0°	Ta=25˚C	—	15	30	ms		(1)(4)(5)
				Ta=0˚C	—	50	100	ms		
Response Time(OFF) (W→B)		t_{off}	$\theta_{L,R,U,D}$=0°	Ta=25˚C	—	10	25	ms		
				Ta=0˚C	—	50	100	ms		
Brightness		I	② $\theta_{L,R,U,D}$=0° V_{CC}=5V I_L=7mA fL=50kHz R*,G*,B* Signal =All "H"		200	250		cd/m²	White *1	(1)(5)
Brightness Uniformity		△I			70	—	—	%		(1)(5)(7)
Chromaticity	W	x			0.293	0.323	0.353	—		(1)(5)
		y			0.307	0.337	0.367	—		
	R	(x, y)		Red	(0.648 , 0.346) Typ.					
	G			Green	(0.292 , 0.602) Typ.					
	B			Blue	(0.150 , 0.130) Typ.					
LCD Panel Type					TFT Color					
Display Mode					Normaly Black					
Wide Viewing Angle Technology					MVA					
Optimum Viewing Angle					— (symmentry)					(6)
Display Color					16,777,216 (8-bit color)					
Color of non-display area					Black					
Surface Treatment					Anti-glare (Haze value: 25%), 2H)					

(*1) Value at 15～20 minutes after lighting on.

② (Note) ･CS-1000 (MINOLTA Co., Ltd.) Field=1° , L=500mm

･Back-light current = 7mA, Dark room condition(1 lux or less)

Be carefull that the luminance meter, which you use, may not be able to get correct brightenss if it's no set correctly.

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Note 1) Definition of Viewing Angle (1)

Based on Figure 9-1.

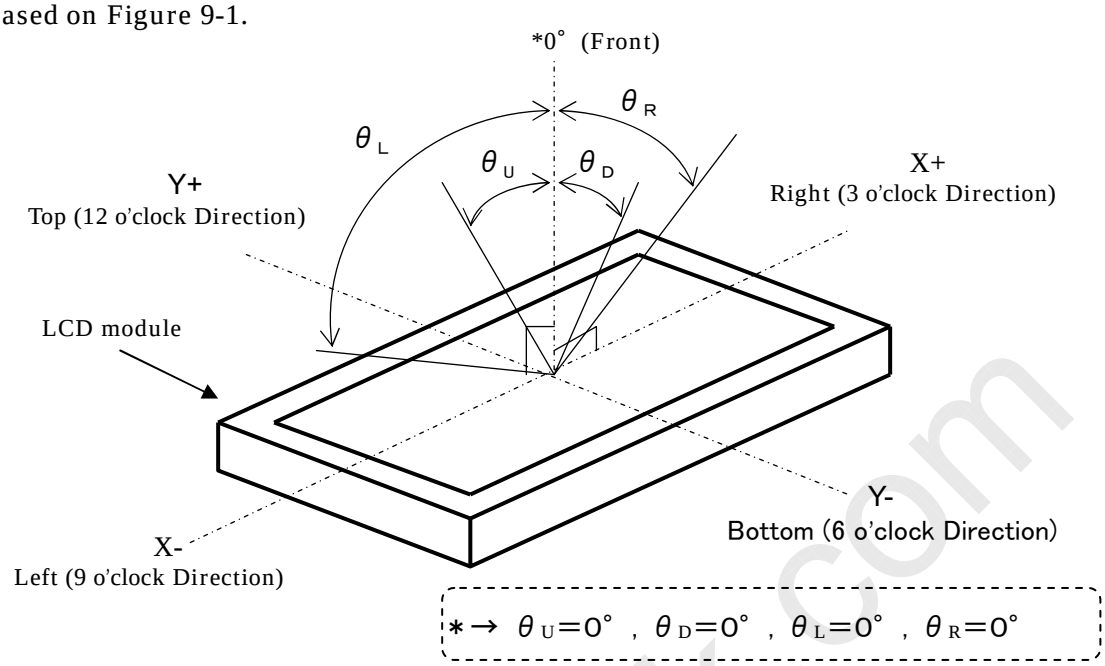

Figure 9-1 Definition of Viewing Angle (1)

Note 2) Definition of Viewing Angle (2)

Based on Figure 9-2.

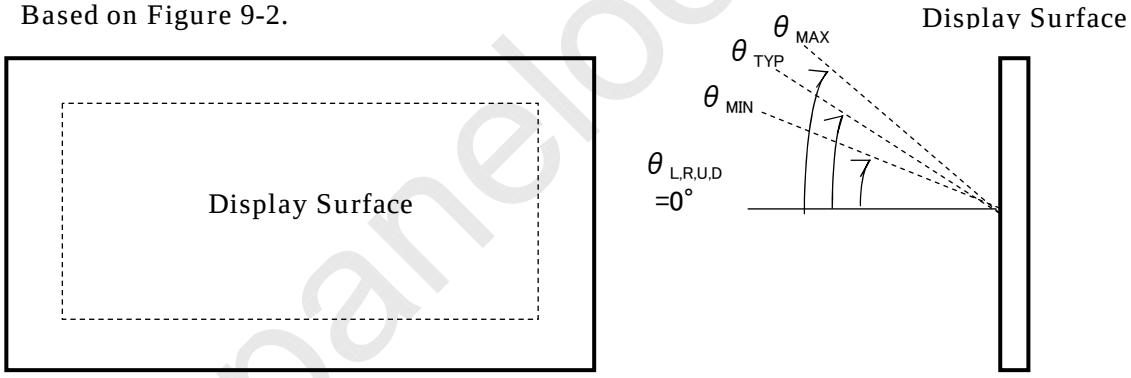

Figure 9-2 Definition of Viewing Angle (2)

Note 3) Definition of Contrast Ratio (CR)

Determined by Formula (1) based on Figure 9-3 Voltage-Brightness characteristics.

$$= \frac{L_W \text{ (Brightness at white)}}{L_B \text{ (Brightness at black)}} \quad \cdots\cdots(1)$$

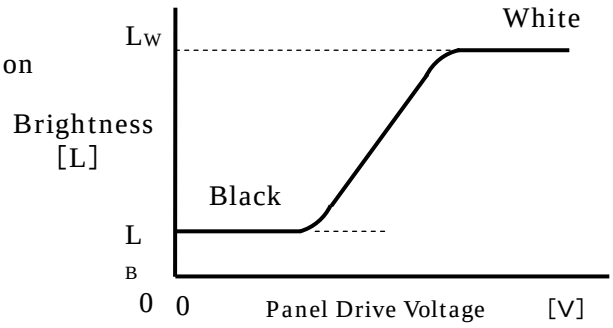

Figure 9-3 Voltage-Brightness Characteristics

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Note 4) Definition of Response Time

Based on Figure 9-4.

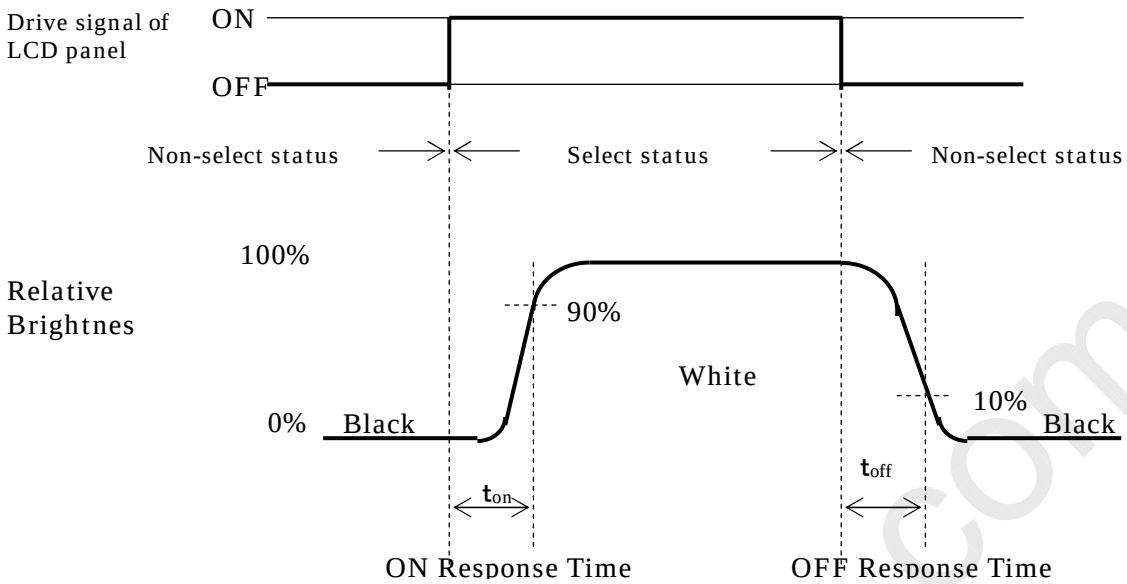

Figure 9-4 Definition of Response Time

Note 5) Contrast Ratio and Response Measurement System

Based on Figure 9-5.

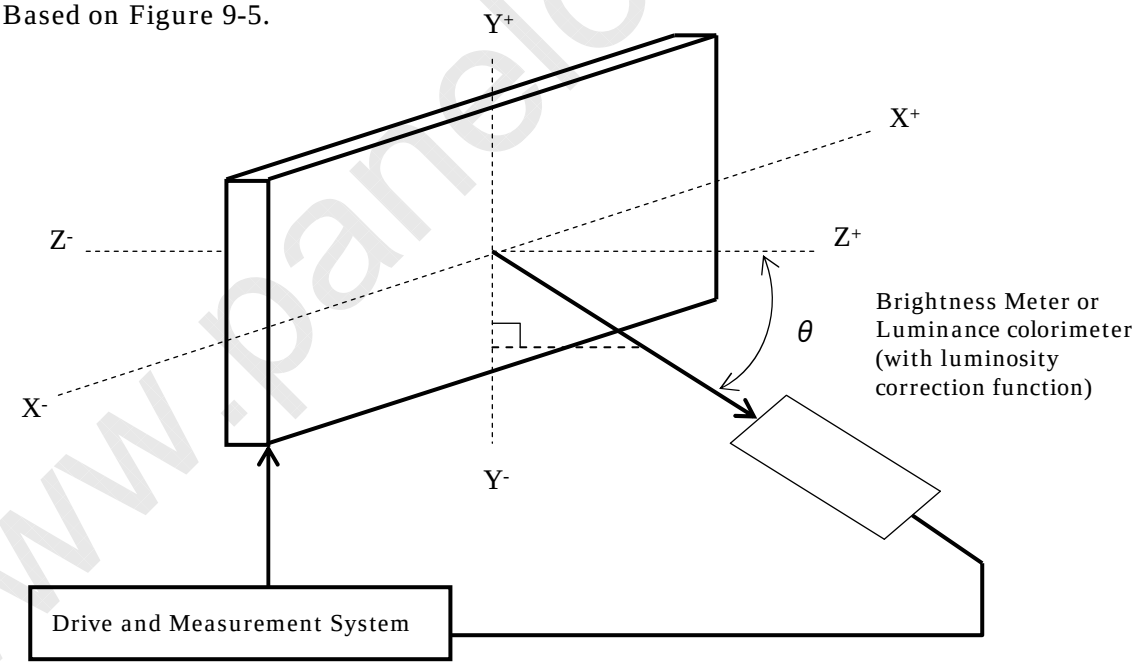

Figure 9-5 Contrast Ratio and Response Time Measurement System

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Note 6) Definition of Optimum Viewing Angle

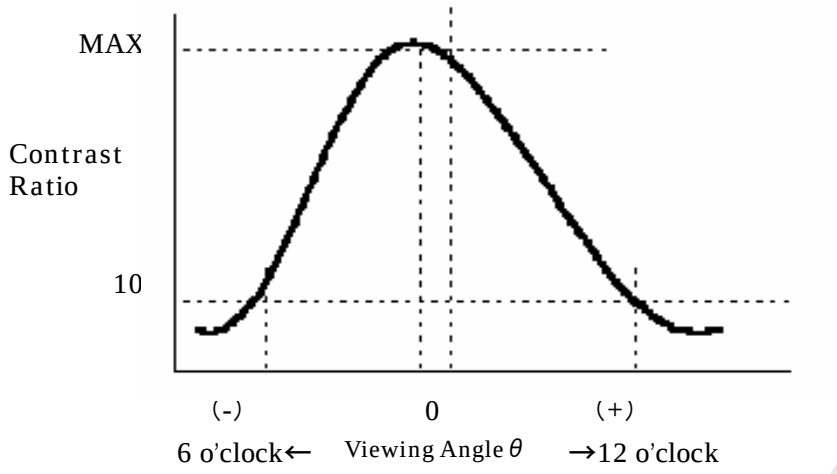


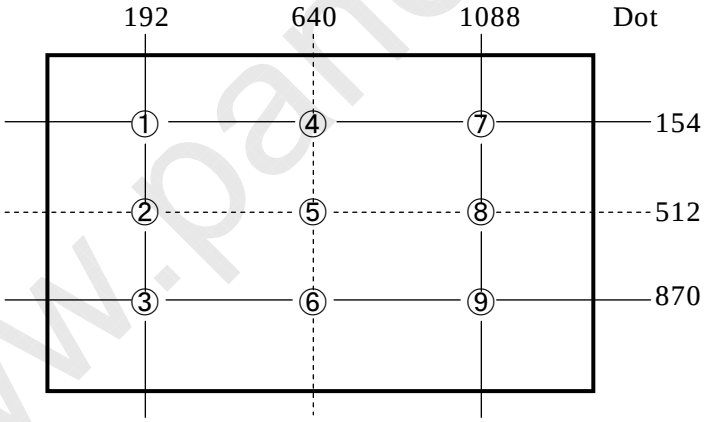
Figure 9-6 Definition of Viewing Angle

Note 7) Definition of Brightness Uniformity

Brightness uniformity is defined by the following formula.

Brightness (I1～I9) art measured at the following 9 points (①～⑨) on the display area that is shown in Figure 9-7.

$$\text{Brightness Uniformity } (\triangle L) = \frac{|\text{Min. In}|}{|\text{Max. In}|} \times 100\ (\%)\ ,\ n = 1 \text{ to } 9$$



Note) Each measurement point (①～⑨) defines the center spot of view of Brightness Meter.
The tolerance of measurement position is±3mm.

Figure 9-7 Measurement Points

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10. INTERFACE SPECIFICATIONS

10-1 Signal descriptions

Table 10-1 shows the description and configuration of interface signals (CN1).

Table 10-1 Interface signals (CN1)

Pin No.	Symbol	I/O	Function
1	RxO0-	I	Negative differential input
2	RxO0+	I	Positive differential input
3	RxO1-	I	Negative differential input
4	RxO1+	I	Positive differential input
5	RxO2-	I	Negative differential input
6	RxO2+	I	Positive differential input
7	GND	—	Ground
8	RxOC-	I	Negative differential input
9	RxOC+	I	Positive differential input
10	RxO3-	I	Negative differential input
11	RxO3+	I	Positive differential input
12	RxE0-	I	Negative differential input
13	RxE0+	I	Positive differential input
14	GND	—	Ground
15	RxE1-	I	Negative differential input
16	RxE1+	I	Positive differential input
17	GND	—	Ground
18	RxE2-	I	Negative differential input
19	RxE2+	I	Positive differential input
20	RxEC-	I	Negative differential input
21	RxEC+	I	Positive differential input
22	RxE3-	I	Negative differential input
23	RxE3+	I	Positive differential input
24	GND	—	Ground
25	TST	—	Test pin *1
26	PD	I	LVDS Core Power Down
27	TST	—	Test pin *1
28	Vcc	—	+5V power supply
29	Vcc	—	+5V power supply
30	Vcc	—	+5V power supply

Connector : FI-X30S-HF (Japan Aviation Electronics)
User's connector : FI-X30M (FPC type) (Japan Aviation Electronics)
FI-X30H (Wire type)
FI-X30C (Coaxial cable type)

*1: Keep open. (Internal test use only.)

②*2: When using a connector other than the recommended one , a defect in the initial stage or a problem concerning long term reliability may occur.

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10-2 LVDS Data Assignment

Table 10-2 shows the LVDS Data Assignment.

Table 10-2 LVDS Data Assignment

Input signal *1		Transmitter DS90CF383,C385 pin	Transmitter DS90CF383,C385 INPUT	Interface connector System side	Interface connector LCD module pin	Interface connector LCD module	Receiver DS90CF386 pin	Receiver DS90CF386 OUTPUT	LCD Control input
LVDS Odd	RO2	51	TxIN0	Tx OUT0+	2	RxO0+	27	RxOUT0	RO2
	RO3	52	TxIN1				29	RxOUT1	RO3
	RO4	54	TxIN2				30	RxOUT2	RO4
	RO5	55	TxIN3				32	RxOUT3	RO5
	RO6	56	TxIN4	Tx OUT0-	1	RxO0-	33	RxOUT4	RO6
	RO7	3	TxIN6				35	RxOUT6	RO7
	GO2	4	TxIN7				37	RxOUT7	GO2
	GO3	6	TxIN8	Tx OUT1+	4	RxO1+	38	RxOUT8	GO3
	GO4	7	TxIN9				39	RxOUT9	GO4
	GO5	11	TxIN12				43	RxOUT12	GO5
	GO6	12	TxIN13				45	RxOUT13	GO6
	GO7	14	TxIN14	Tx OUT1-	3	RxO1-	46	RxOUT14	GO7
	BO2	15	TxIN15				47	RxOUT15	BO2
	BO3	19	TxIN18				51	RxOUT18	BO3
	BO4	20	TxIN19	Tx OUT2+	6	RxO2+	53	RxOUT19	BO4
	BO5	22	TxIN20				54	RxOUT20	BO5
	BO6	23	TxIN21				55	RxOUT21	BO6
	BO7	24	TxIN22				1	RxOUT22	BO7
	RSVD	27	TxIN24	Tx OUT2-	5	RxO2-	3	RxOUT24	Not use
	RSVD	28	TxIN25				5	RxOUT25	Not use
	ENAB	30	TxIN26				6	RxOUT26	ENAB
	RO0	50	TxIN27	Tx OUT3+	11	RxO3+	7	RxOUT27	RO0
	RO1	2	TxIN5				34	RxOUT5	RO1
	GO0	8	TxIN10				41	RxOUT10	GO0
	GO1	10	TxIN11				42	RxOUT11	GO1
	BO0	16	TxIN16	Tx OUT3-	10	RxO3-	49	RxOUT16	BO0
	BO1	18	TxIN17				50	RxOUT17	BO1
	RSVD	25	TxIN23				2	RxOUT23	Not use
	DCLK	31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	9 8	RxCLK IN+ RxCLK IN-	26	RxCLK OUT	DCLK
LVDS Even	RE2	51	TxIN0	Tx OUT0+	13	RxE0+	27	RxOUT0	RE2
	RE3	52	TxIN1				29	RxOUT1	RE3
	RE4	54	TxIN2				30	RxOUT2	RE4
	RE5	55	TxIN3				32	RxOUT3	RE5
	RE6	56	TxIN4	Tx OUT0-	12	RxE0-	33	RxOUT4	RE6
	RE7	3	TxIN6				35	RxOUT6	RE7
	GE2	4	TxIN7				37	RxOUT7	GE2
	GE3	6	TxIN8	Tx OUT1+	16	RxE1+	38	RxOUT8	GE3
	GE4	7	TxIN9				39	RxOUT9	GE4
	GE5	11	TxIN12				43	RxOUT12	GE5
	GE6	12	TxIN13				45	RxOUT13	GE6
	GE7	14	TxIN14	Tx OUT1-	15	RxE1-	46	RxOUT14	GE7
	BE2	15	TxIN15				47	RxOUT15	BE2
	BE3	19	TxIN18				51	RxOUT18	BE3
	BE4	20	TxIN19	Tx OUT2+	19	RxE2+	53	RxOUT19	BE4
	BE5	22	TxIN20				54	RxOUT20	BE5
	BE6	23	TxIN21				55	RxOUT21	BE6
	BE7	24	TxIN22				1	RxOUT22	BE7
	RSVD	27	TxIN24	Tx OUT2-	18	RxE2-	3	RxOUT24	Not use
	RSVD	28	TxIN25				5	RxOUT25	Not use
	RSVD	30	TxIN26				6	RxOUT26	Not use
	RE0	50	TxIN27	Tx OUT3+	23	RxE3+	7	RxOUT27	RE0
	RE1	2	TxIN5				34	RxOUT5	RE1
	GE0	8	TxIN10				41	RxOUT10	GE0
	GE1	10	TxIN11				42	RxOUT11	GE1
	BE0	16	TxIN16	Tx OUT3-	22	RxE3-	49	RxOUT16	BE0
	BE1	18	TxIN17				50	RxOUT17	BE1
	RSVD	25	TxIN23				2	RxOUT23	Not use
	DCLK	31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	21 20	RxCLK IN+ RxCLK IN-	26	RxCLK OUT	Not use

*1 •RSVD (reserved) pin on a transmitter should be connected with Ground.

•Input odd or even data depending on the display position of the LCD module.

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10-3 Color Data Assignment

Table 10-3 shows the Color Data Assignment.

Table 10-3 Color Data Assignment

Color			R Input data								G Input data								B Input data							
	Odd / Even		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
			R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red		1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta		1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	⇩	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Brighter	253	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	254	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	⇧	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	⇩	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Brighter	253	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	⇩	254	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	⇧	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	⇩	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Brighter	253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	⇩	254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note.1) Definition of gray scale:Color (n)…"n" indicates gray scale level.
Larger number means brighter level.
Note.2) Data; 1:High, 0:Low

Note 3) Color data consist of 8 bit red, green and blue data of odd and even number pixel data. Total data number is 48 signals. This module is able to display 16,777,216 colors because each red, green and blue data is controlled independently.

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10-4 Input Signal Timing

Table 10-4 and Figure 10-1 shows the Input Signal Timing at LVDS transmitter.

Table 10-4 Timing Characteristics (Ta=0~50˚C, Vcc=5±0.25V)

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK signal (Clock)	Period	Tc	16.7	18.5	25.0	ns	
	Frequency	1/Tc	40	54	60	MHz	
	Duty	Tch/Tc	45	50	55	%	
	High time	TclkH	5.0	—	—	ns	
	Low time	TclkL	5.0	—	—	ns	
DCLK-Data Timing	Setup time	Tset	3	—	—	ns	
	Hold time	Thold	5	—	—	ns	
ENAB signal	Horizontal Period	Th	5500/Tc+450	844	887 *1	DCLK	
	Hor. Period (1)	Th	14.0	15.6	—	µs	*4
	Hor. Period (2)	Th	10.6	15.6	—	µs	*4
	Hor. Display period	Thd	640	640	640	DCLK	*2
	Vertical Period	Tv	1028 *1	1066	1088 *1	Th	16.67ms
	Ver. Frequency	1/Tv	50	60	69	Hz	
	Ver. Display period	Tvd	1024	1024	1024	Th	*2
	Data-ENAB timing	Tdn	—	0	—	DCLK	*3

*1) • horizontal display position is specified by the rise of ENAB.
The data latched at falling edge of DCLK after rise of ENAB is displayed at the left edge of the display area.
• Vertical display position is specified by the rise of ENAB after low level continuation over 2048 DCLK.
The data latched at the rise of ENAB is displayed at the top line of the display area.

*2) • If the "High" level period of ENAB is less than 640 DCLK or the number of ENAB in a frame period (Tv) is less than 1024, black color is displayed at the rest of the display area.

*3) • If ENAB does not synchronize with the effective display data, the display position does not fit to the display area.

*4) • Hor. Period (2) shows the operating range where internal circuit can work correctly.
• When ENAB signal is out of Hor. Period (1), the display quality may deteriorate.

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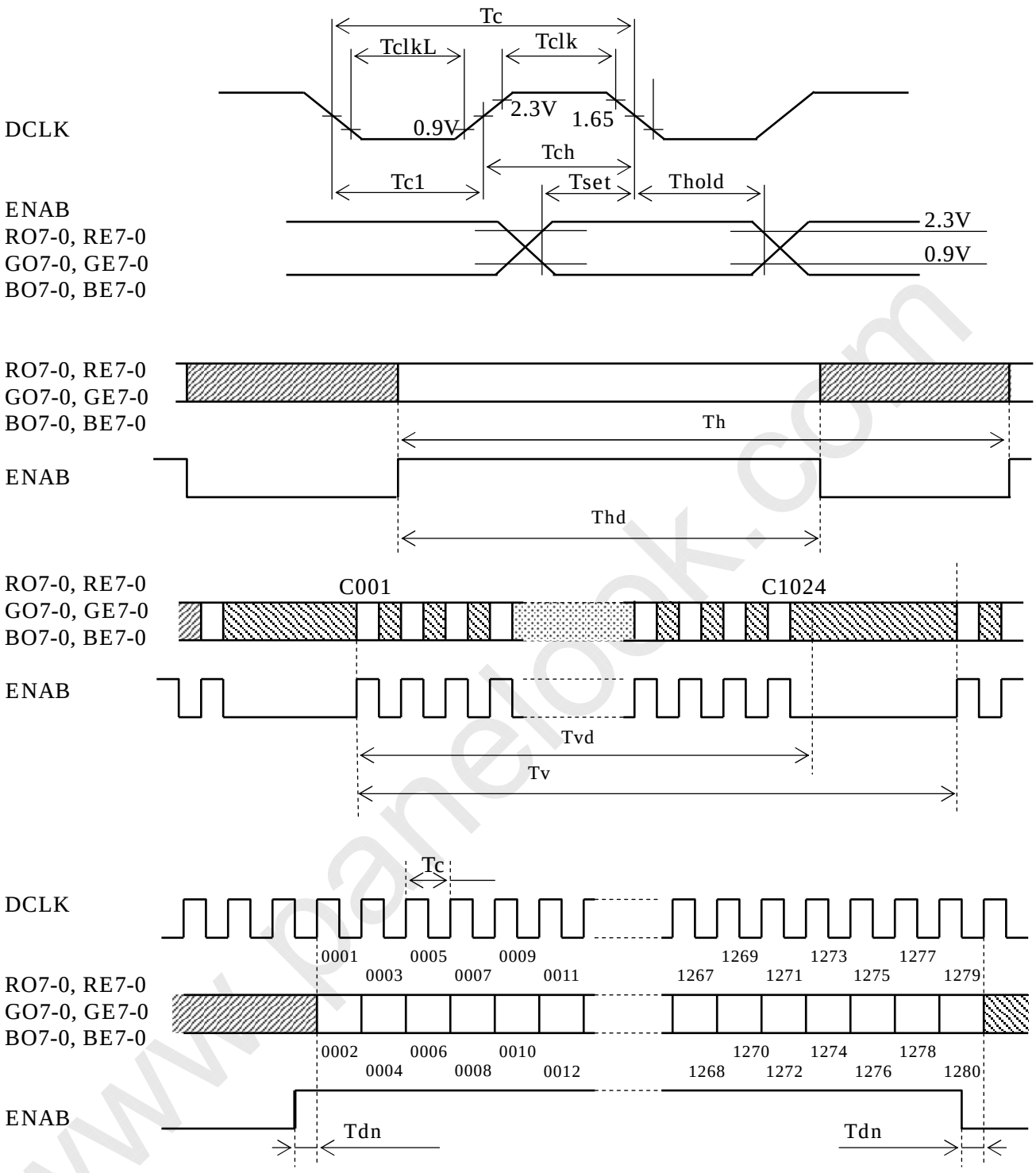

Figure 10-1 Input Signal Timing Chart

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10-5 Correspondence between Data and Display Position

Figure 10-2 shows the Correspondence between Data and Display Position.

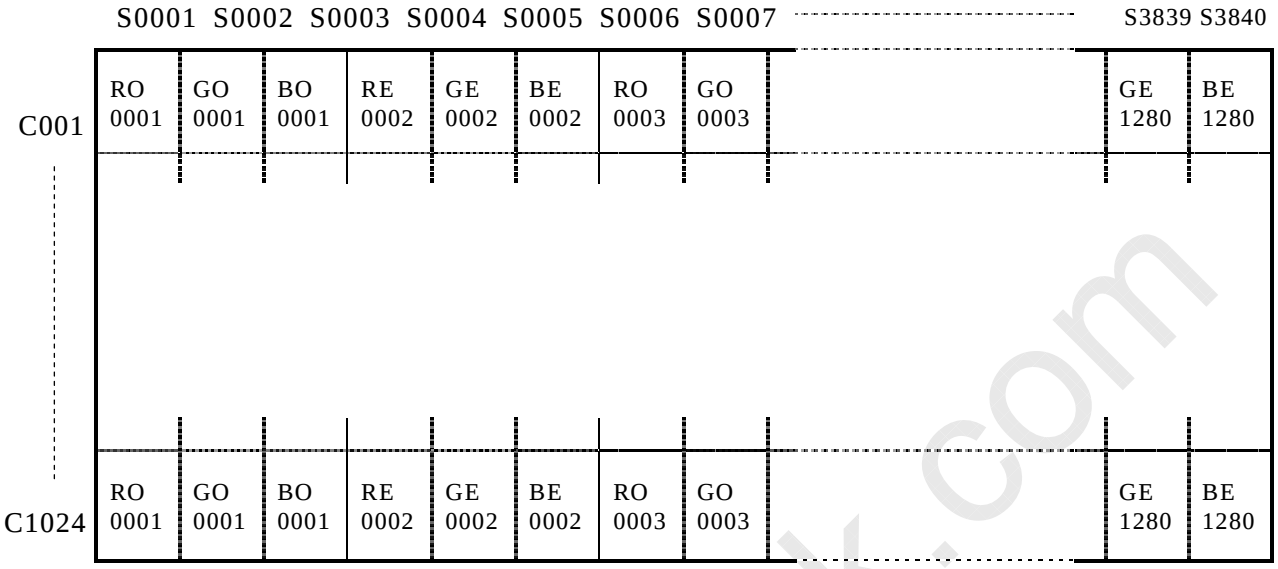
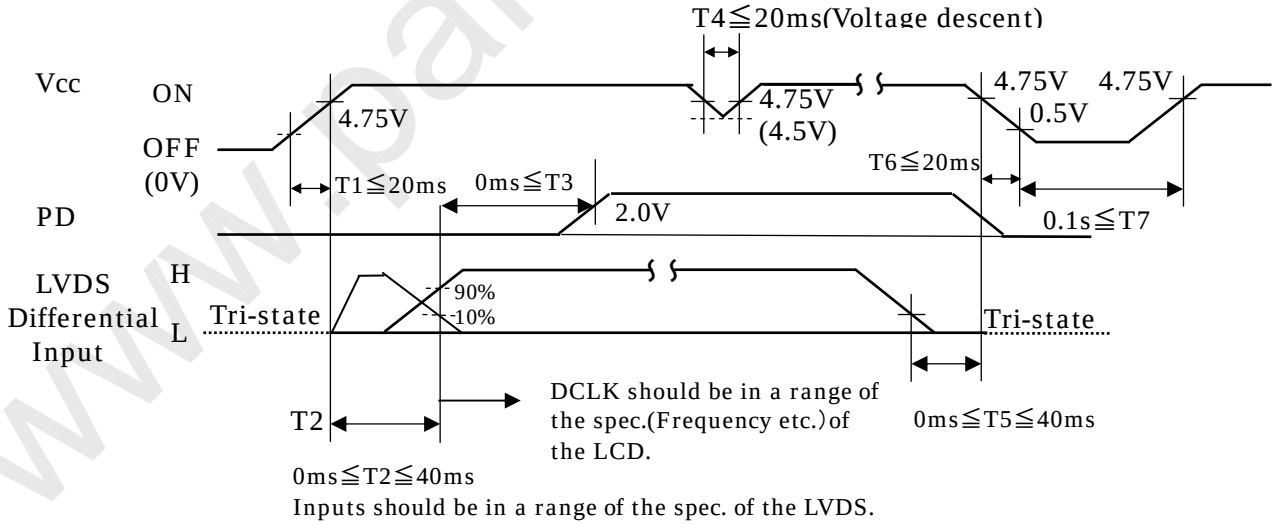


Figure 10-2 Correspondence Data and Display Position

10-6 Power Supply Sequence

The sequence of input signals and On/Off of the power supply of this LCD module should be in the specification shown in Figure 10-3 to prevent latch-up of the driver ICs and DC driving of the LCD panel.



*Note : PD input can be set open, if it is not used.

Figure 10-3 Power Supply Sequence

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11. BACK-LIGHT SPECIFICATIONS

11-1 Pin configuration for Back-light

Table 11-1 shows the description and Pin assignment of the connectors (CN-A to D) for the Back-light of this LCD module.

Table 11-1 Pin Assignment of CN-A to CN-D

Pin No.	Signal				Function	Cable color
	CN-A	CN-B	CN-C	CN-D		
1	V_{L1}	V_{L2}	V_{L3}	V_{L4}	Power supply	Pink
2	—	—	—	—	—	—
3	GND	GND	GND	GND	Ground	White or Blue

Connector : Housing : BHR-03VS-1
Contact : SBH-001T-P0.5
User's Connector : Post with base: SM02(8.0)B-BHS-1-TB
Supplier : Japan Solderless Terminal Trading Company LTD. (J.S.T.)

11-2 Life

The life of the back-light is a minimum of 50,000 hours at the following conditions.

(1) Working conditions

①Ambient temperature： 25±5℃
②Tube current (I_L) ： (7mA or less)

(2) Definition of life

①Brightness becomes 50% or less than the minimum brightness value shown in Table 9-1.
②The lamp cannot be lit by the minimum value of the breakdown voltage(1760Vrms) shown in Table 8-1.
③Flashing.

11-3 Lamp assembly set (for replacement)

Lamp assembly set(with charge)is prepared for replacing old lamp to new one.
This set consists of a upper lamp assembly and a lower lamp assembly.

Type number : FLCL-20

Drawing No. : NA19020-5906

Minimum order qty. unit : 20 pcs.

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12. APPEARANCE SPECIFICATIONS

12-1 Appearance

No.	Item	Judgment method and standard	
1	Bright spot (high and Low)	≦ 8 dots	(Note 1)
2	Bright spot connection (high and Low)	2 dots connection ≦ 2 pair 3 dots connection ≦ 1 pair	(Note 1)
3	Total of bright spot	≦ 8 dots	
4	Dark spot	≦ 10 dots	(Note 2)
5	Dark spot connection	2 dots connection ≦ 3 pair 3 dots connection ≦ 1 pair	(Note 2)
6	Total of dark spot	≦ 10 dots	(Note 2)
7	Total of dot defect	≦ 18 dots	
8	Distance of dot defect	≧ 2mm	
9	Black / white spot	D ≦0.3	Ignore
		0.3< D ≦0.6	N ≦5
		0.6< D ≦0.9	N ≦2 (Distance ≧100mm)
		0.9< D	0
10	Mura	Ignore	

D:Average diameter [mm], W:Width [mm], L:Length [mm], S=(bright spot size)/(dot size)

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12-2 Dot defects (Bright spots, Dark spots)

12-2-1 Zone

· Inside display dot area (376.32×301.056mm)
· Display dot area means active area.
· One pixel consists of 3 dots (red, green and blue).
· Foreign particle and scratch unharmful to display image, such as the foreign particle under polarizer film but outside of the display area and scratch on metal bezel, backlight module or polarizer film out of the display area, etc., are not counted.

12-2-2 Bright spots

(1) Bright spots by the defect of TFT.
· Visible under bias of 2% ND filter..... High bright spot R•G
· Visible under 5% but invisible under 2% ND filter..... Low bright spot R•G•B
· Invisible under bias of 5% ND filter..... Not counted

(2) Bright spots by the light passing through tears, breaks, etc in color filter.
· Exceed size of a half dot ..... High bright spot
· A half dot or less..... Not counted

(3) Bright spots by the light passing through tears, breaks, etc in chromium mask.
· Exceed 50μm ..... High bright spot
· 50μm or less ..... Not counted

12-2-3 Test condition

· Inspector must observe the LCD screen from the normal direction under the illumination by a single 20W fluorescent lamp. The distance between the LCD screen and the inspector should be a height of 50cm above the worktable.
The vertical illuminance is 300 to 600lux (reference value).
· Bright spot should be counted under entire black screen.
· Dark spot should be counted under entire white screen.
· Input signal timing should be typical value.

(Note1) Please do not mistake a single bright spot for a bright spot connection due to Cs(supplemental capacitance) line at the center of each dot.
(Note2) If a pixel is dark partially, it connects into the number of dark spots in accordance with following rule.
(a) A<1/3 : Not count. Only one of 4 dark connection is allowed.
(b) 1/3≦A<2/3 : Considered as 0.5 dot.
(c) 2/3≦A : Considered as 1 dot.
(A=Dark spot size/dot size)

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13. ENVIRONMENTAL SPECIFICATIONS

Table 12-1 shows the environmental specifications.

Table 12-1 Environmental specifications

Item	Condition		Remark
Temperature	Operation	0～55℃	Temperature on surface of LCD panel (display area.)
	Storage	–20~60ºC	
Humidity	Operation	20~85%RH	Maximum wet-bulb temperature should not exceed 29ºC. No condensation.
	Storage	5~85%RH	
Vibration	Non-operation	10~500Hz, 1octave/ 20minute, 19.6m/s²(2G), 1.5mm max, 1hour each X, Yand Z directions.	For single module without package.
Shock *1	Non-operation	294m/s² (30G), 6ms, 1time each ±X, ±Y and ±Z directions.	

*1) When LCD module is mounted with side mount holes, the shock condition is 196m/s²(20G).

NOTE：Table 13-2 and Figure 13-1 show the shock resistance standard when module is packaged.

Table 12-2 Shock resistance standard when module is packaged

Dropping location	Dropping height	Count
A~J	60cm	1 time

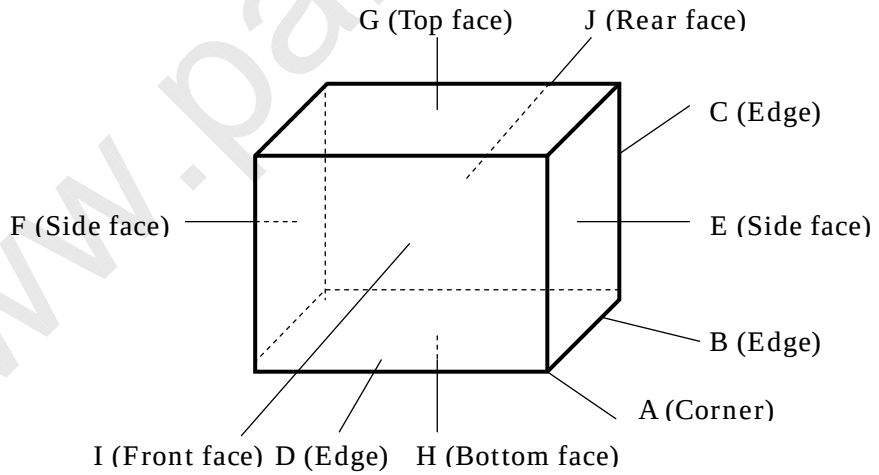

Figure 12-1 Direction to apply shock to package

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14. INDICATIONS

This module has the following indications.

(1) Product name : **LCD unit**

(2) Model Number : NA19020-C961

(3) Manufacturing Number : **3 5 0 0 0 0 1**

- Serial number (To be reset every month on 1st.)
- Manufacturing month (Oct. = X, Nov. =Y, Dec. =Z)
- Last digit of manufacturing year.

(4) Manufacturer Country Name :

(5) Disposal method of cold-cathode tubes. (See Figure 13-2)

(6) Caution when changing cold-cathode tubes. (See Figure 13-3)

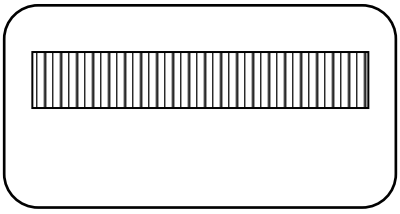

Figure 13-1 Product Label (Example)

Figure 13-2

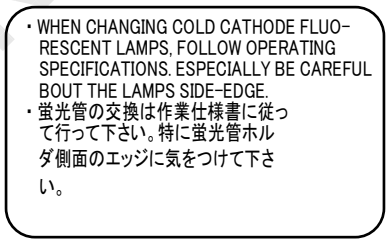

Figure 13-3

15. PACKAGING

15-1 Packing specifications

(1) 5 LCD modules/1package.

(2) Weight:approximately 16kg/1package.

(3) Outline dimensions: 534mm (W)x329mm (D)x 480mm (H)

15-2 Packing method

Figure 15-2 shows the packing method.

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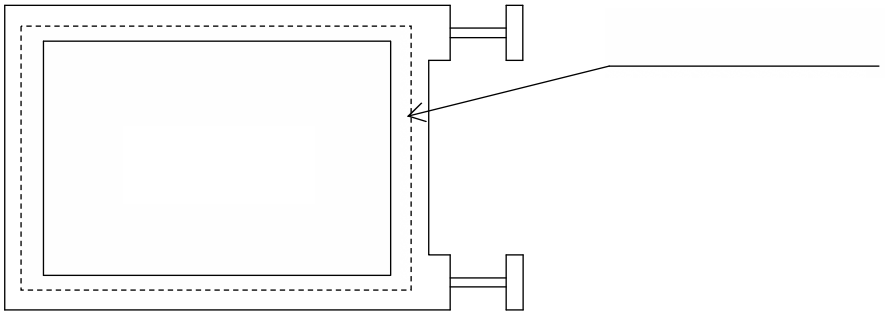

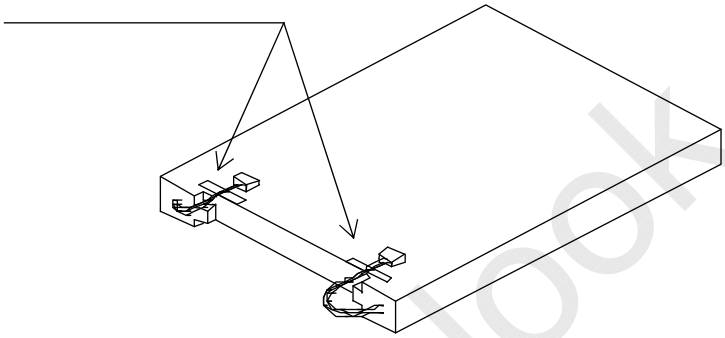

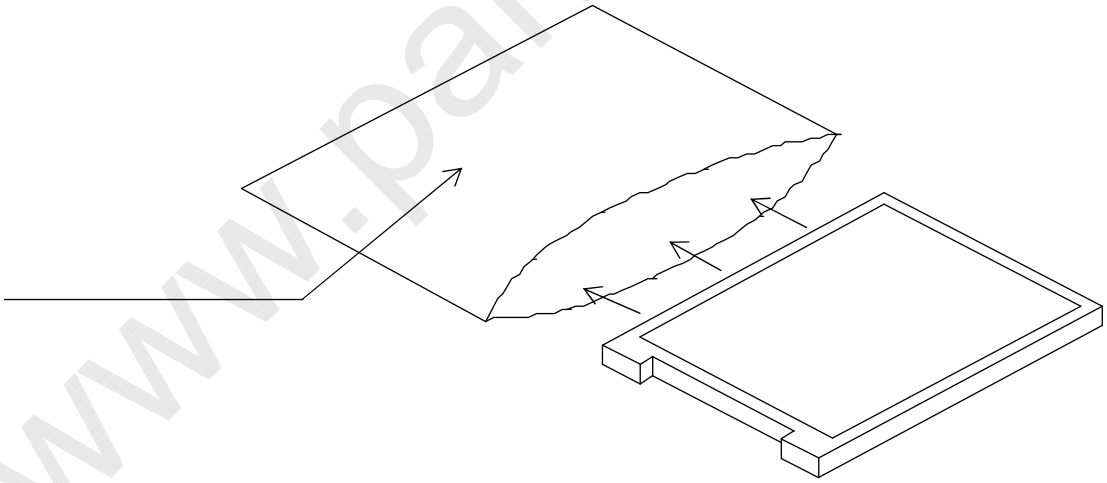

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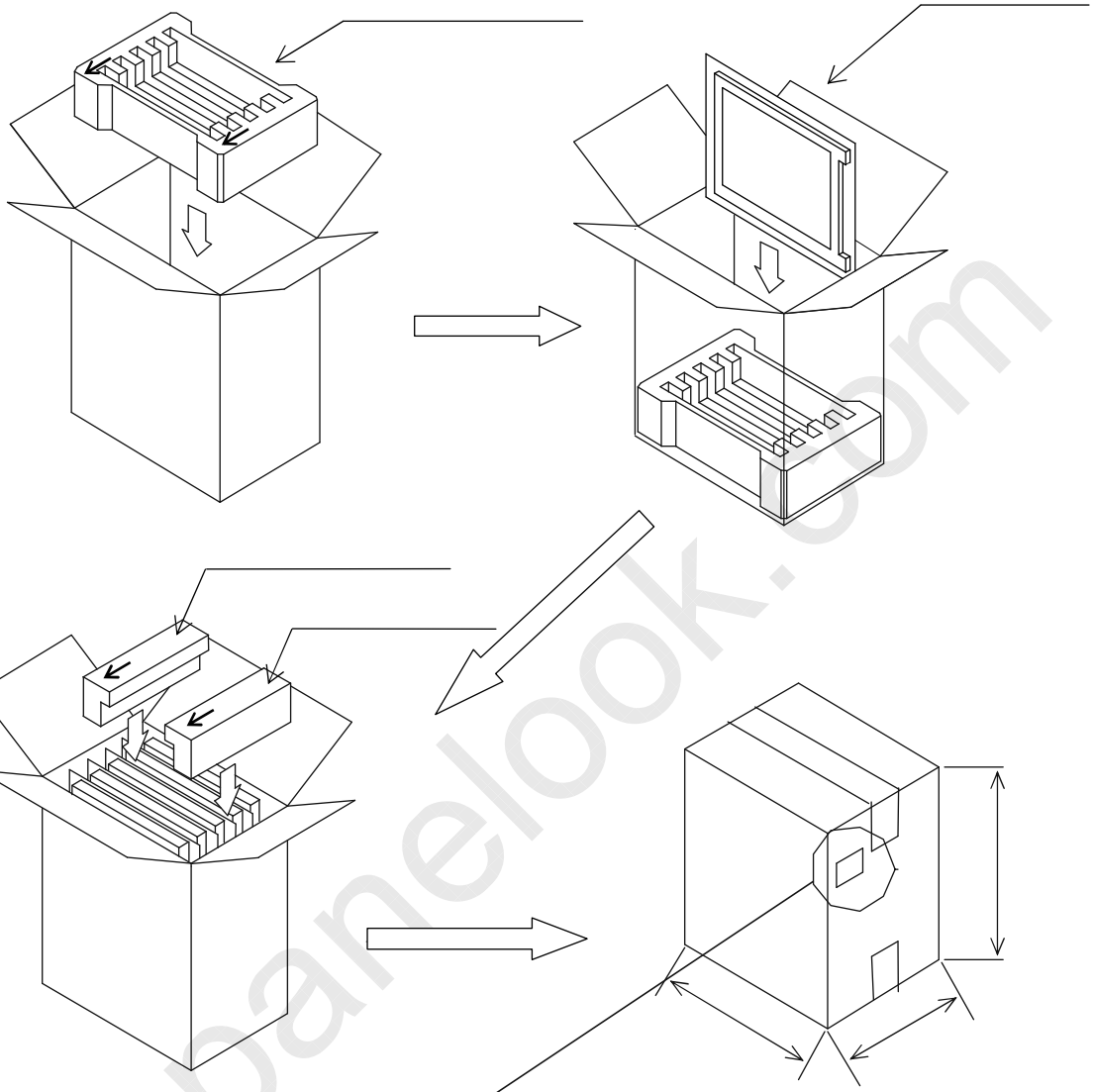

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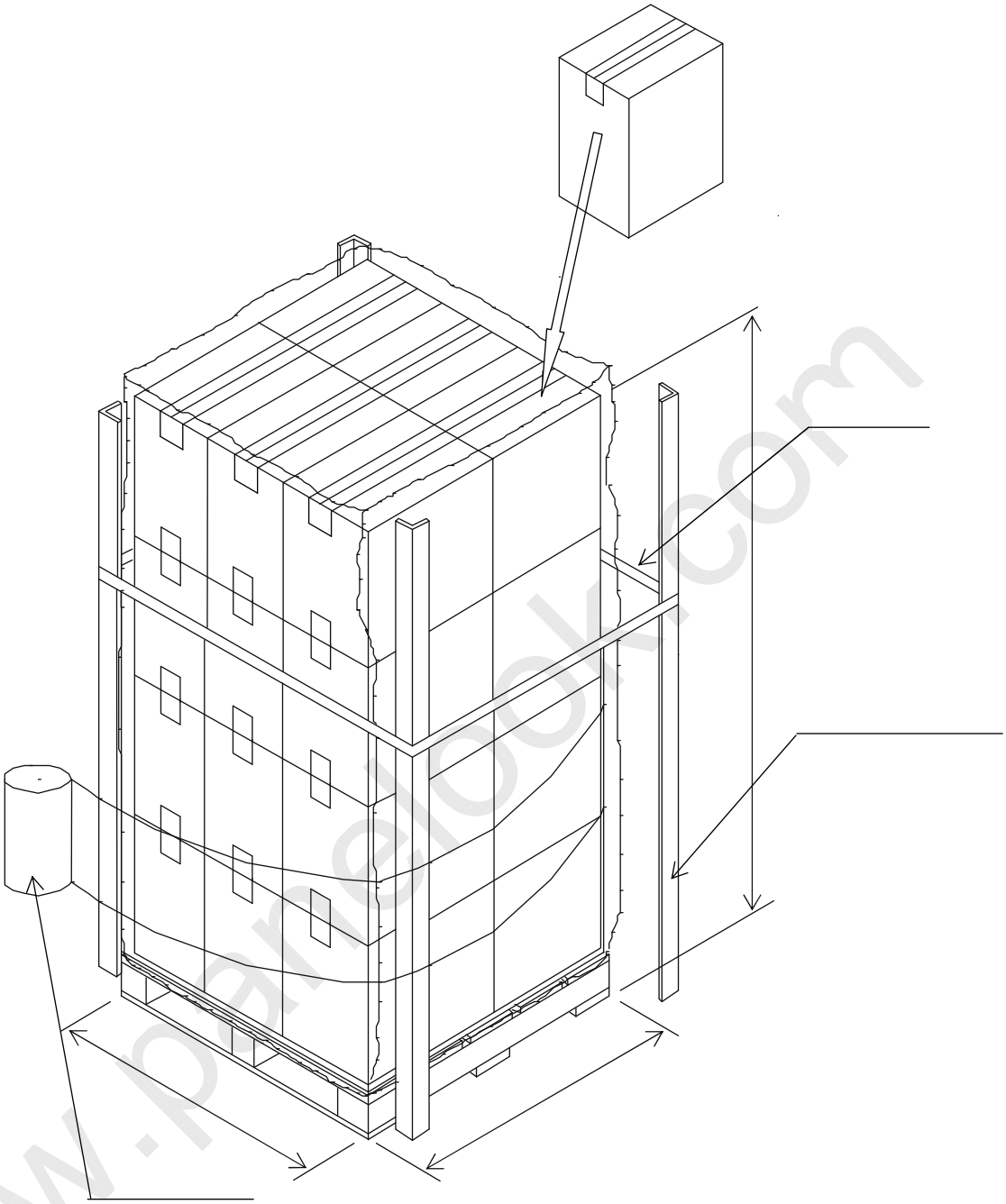

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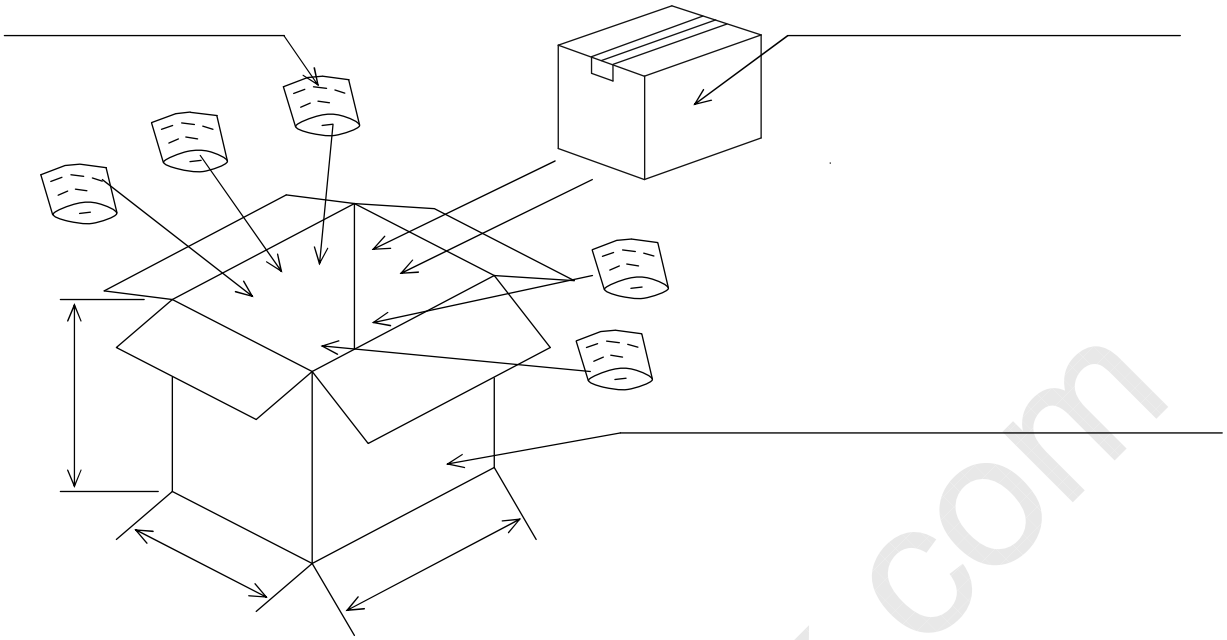

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16.PRECAUTIONS

(1) Fail safe design

(2) Handling of LCD panel

① Do not apply any strong mechanical shock to the LCD panel.

② Do not press hard on the LCD panel surface. (Max: 2kg/cm²)

①
②
①
②

③ Do not scratch the polarizer film on the LCD panel surface.

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④ Do not place or contact objects on the display surface for a long period of time.

(3) Handling of LCD module

① Do not pull the cold-cathode tube cable strongly.

② Assemble the module into user's system in a dust free environment.

③ Take anti-electrostatic measures for assembling the module.

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④ Do not pull the connecting cable on the rear face of the LCD module strongly.

⑤ Do not disassemble or remodel the LCD module.

(4) Precautions in regards of operating the LCD module

① Adhere to the specified power supply sequence.

② Do not operate the LCD module when condensation occurs.

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③ The following troubles occur when the LCD module is not used under recommended temperature.

- ℃
- ℃
- ℃
- ℃

④ Be sure to input the control signals at the correct timing.

(5) Precautions in regards of designing module mounting

① Excessive force should not be applied to the screen or the rear side of the LCD module.

② Avoid twisting and bending the LCD module.

③ Avoid extending the power cable between the LCD module and inverter.

④ Keep the backlight cable apart from the metal enclosure of the LCD module.

⑤ When mounting LCD module with M3 screws (x4), tighten the screws with torque below.
User hole : 50N(5kgf) , Side mount hole : 30N(3kgf)

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(6) Storage method

① Do not store the LCD module in an atmosphere of organic solvent or corrosive gas.

② Store the LCD module in a Fujitsu package.

③ The LCD module is recommended to be stored in humidity controlled, cool and dark locations.

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(7) Disposal Method

① LCD module

② Package

(8) Others

① If the LCD panel is damaged, do not inhale and do not swallow the liquid crystal.

② Flux residue on the printed circuit board is harmless to the quality and reliability of LCD module.

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17. PRECAUTIONS FOR USE

18. MISCELLANEOUS

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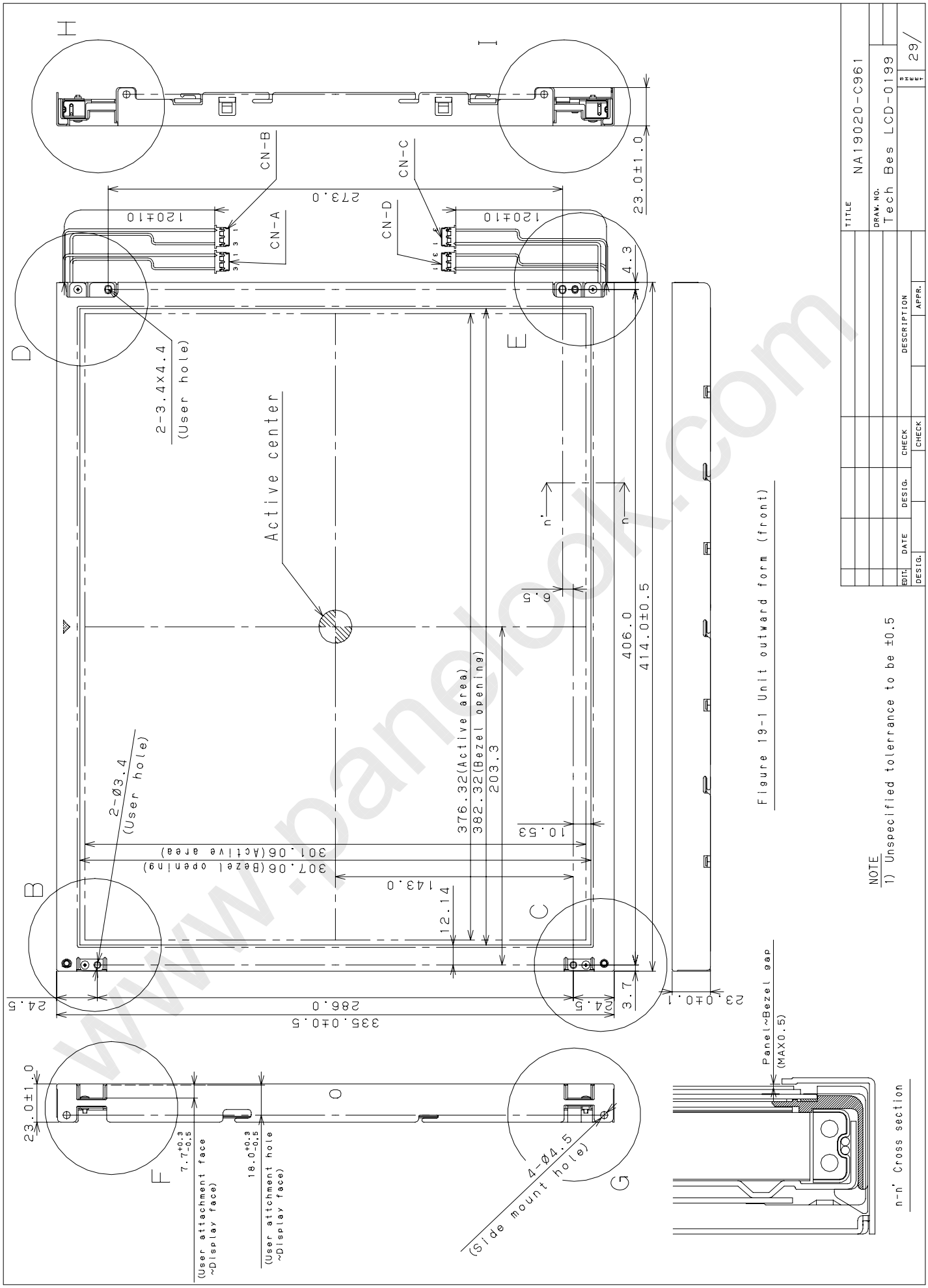

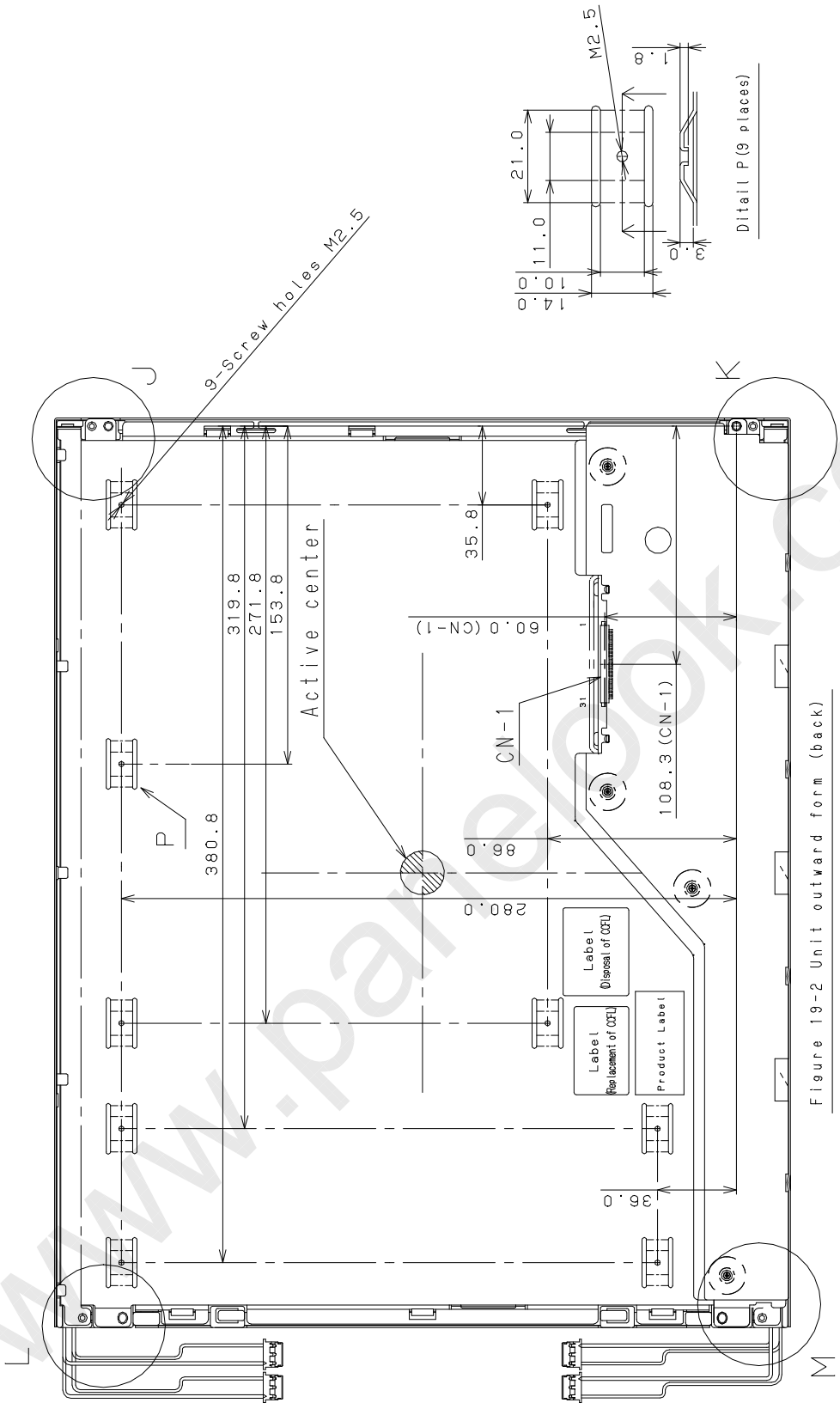

Figure 19-2 Unit outward form (back)

TITLE	NA19020-C961		
DRAW. NO.	Tech Bes LCD-0199	SHEET	30 /

EDIT.	DATE	DESIG.	CHECK	DESCRIPTION	APPR.
DESIG.			CHECK		

NOTE
2) The height of interface connector does not include that of a counterpart connector.

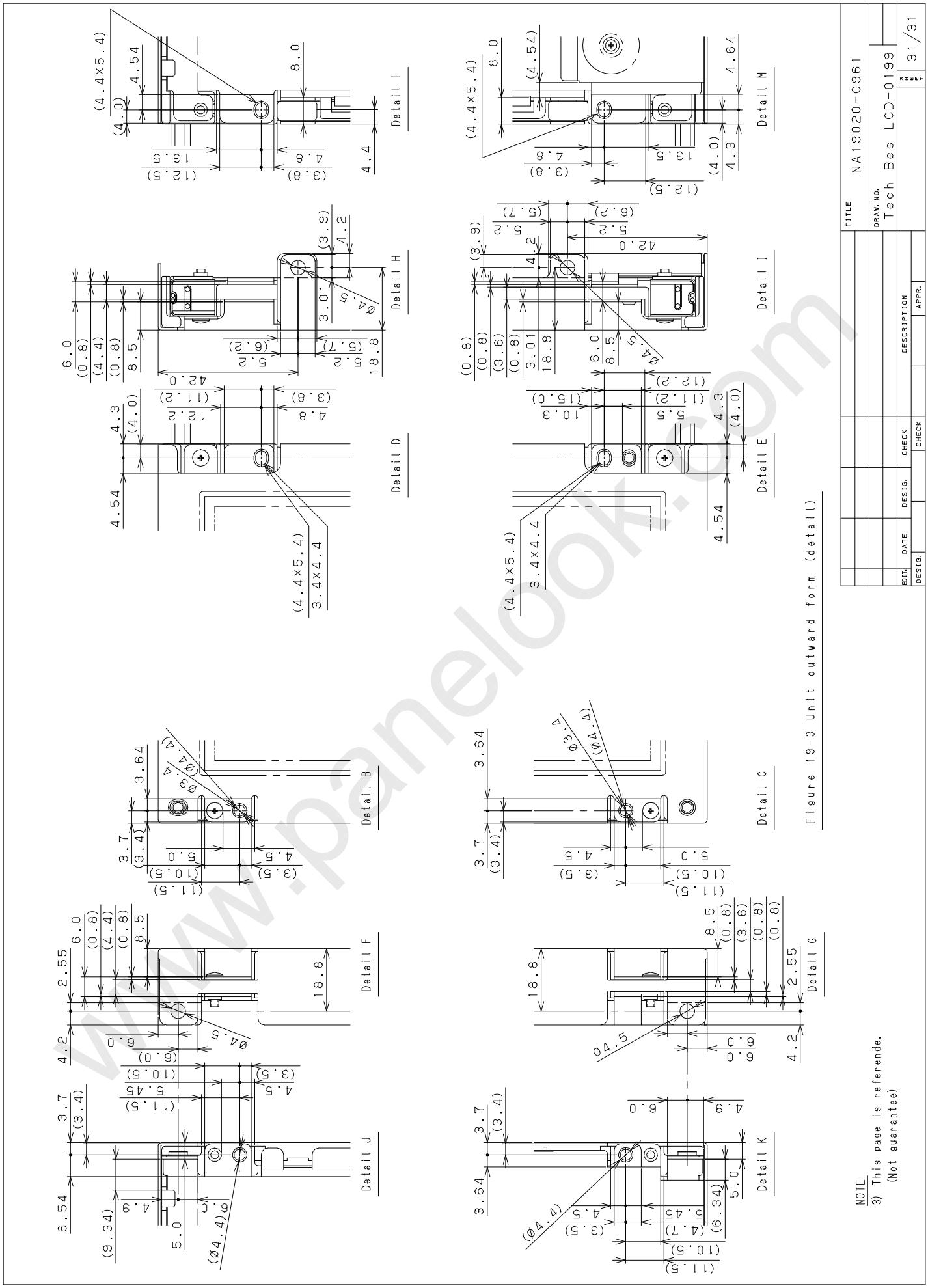

Figure 19-3 Unit outward form (detail)

NOTE
3) This page is referende.
(Not guarantee)